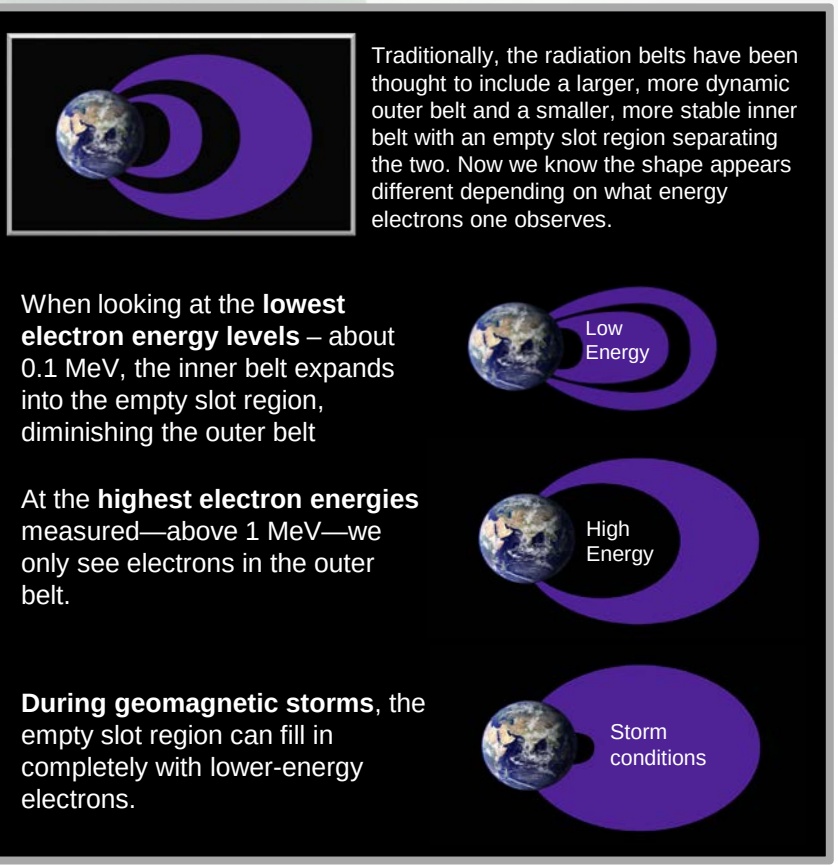
NASA's Van Allen Probes Revolutionize View of Radiation Belts

A new study based on data from NASA's Van Allen Probes shows that all 3 regions—inner belt, slot region, outer belt—can appear different depending on the energy of electrons considered and general conditions in the magnetosphere.

A recent study of data from the Van Allen Probes published on Dec. 28, 2015 in the Journal of Geophysical Research has given us new understandings on the shape of the Van Allen Belts, or radiation belts, and how electrons behave at different energy levels within the belts themselves. This new analysis reveals that the observed shape can vary from a single, continuous belt with no slot region, to a larger inner belt with a smaller outer belt, to no inner belt at all. While the shapes of the belts do change, we now know that most of the observed differences are accounted for by considering electrons at different energy levels separately.

The twin Van Allen Probes satellites expand the range of energetic electron data we can capture. In addition to studying the extremely high-energy electrons—carrying millions of electron volts, the Van Allen Probes can capture information on lower-energy electrons that contain only a few thousand electron volts. Additionally, the spacecraft measure radiation belt electrons at a greater number of distinct energies than was previously possible.

Precise observations like this, from hundreds of energy levels, rather than just a few, will allow scientists to create a more precise and rigorous model of what, exactly, is going on in the radiation belts, both during geomagnetic storms and during periods of relative calm. This information will help us better predict and prepare for dangerous space weather events that have the potential to impact Earth's environs.



The Johns Hopkins Applied Physics Laboratory in Laurel, Md., built and operates the Van Allen Probes for NASA's Science Mission Directorate. The mission is the second mission in NASA's Living With a Star program, managed by NASA's Goddard Space Flight Center in Greenbelt, Md.